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Animal Industry Report

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AS 652

ASL R2160

2006

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A.S. Leaflet R2160

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Summary and Implications

A line of Yorkshire pigs was selected for 3 generations for reduced residual feed intake (RFI), a measure of feed efficiency defined as feed consumed over and above average requirements for maintenance and growth. Heritability estimates of RFI, feed intake, growth, and backfat were 0.30, 0.46, 0.33, and 0.67. Comparison of performance of gilts from the selected line (n=49) to those of a randomly selected control line (n=38) from ~40 to ~70 kg showed that selection had significantly decreased feed intake by 123 g/d. There were no significant differences in average daily gain and backfat between the lines, although the selection line tended to have 22 g/d less growth. In conclusion, RFI is a heritable trait and selection for RFI has significantly decreased the amount of feed required for a given rate of growth and backfat.

Introduction

Feed for the growing phase is the largest variable cost in swine production. Although a large proportion of variation in feed intake is related to production traits, there is considerable variation that is independent of growth and composition. This is referred to as residual feed intake (RFI), i.e. feed consumed over and above expected requirements for production and maintenance. Variation in RFI is not utilized in genetic selection for growth and composition. Factors that contribute to genetic variation in RFI include feeding behavior, nutrient digestion, maintenance requirements, energy homeostasis and energy partitioning. To enable the study of the genetic and physiological basis of feed efficiency, a selection experiment for RFI was initiated. The objective here was to evaluate response to selection in the first 3 generations.

Materials and Methods

Using purebred Yorkshire pigs, a selection experiment for RFI was started in 2001. Starting with random allocation of littermates, in each generation, electronically measured feed intake, body weight, and ultrasound backfat are evaluated from ~40 to ~115 kg on 90 boars from first parity LRFI sows and 90 gilts from second parity LRFI sows. Following evaluation of first parity boars, ~12 LRFI boars and 70 gilts are selected to produce ~50 litters for the next generation. About 30 control line litters are produced by random mating. Selection is on EBV for RFI from animal model analysis of average daily feed intake (FI), with group and sex (fixed), pen within group (random), and covariates for on- and off-test weight and age, for average daily gain (ADG) and backfat (BF). The same model was used to estimate heritability of RFI, FI, and ADG and BF based on data on 638 LRFI pigs with FI data across generations. Since FI is routinely not recorded in the control line, line differences for RFI, FI, ADG and BF were evaluated after 3 generations using phenotypic data on 49 LRFI and 38 control gilts that were simultaneously evaluated for FI from ~40 to ~70 kg. Data were analysed with a mixed model with line as a fixed effect.

Results and Discussion

Estimates of heritabilities and line differences are in Table 1. Residual feed intake contributed nearly 50% of phenotypic variation in feed intake, the rest being explained by variation in growth rate and backfat. Heritability estimate of FI, ADG and BF were within the range observed in literature. RFI had a substantial heritability (0.30). Selection line gilts had significantly lower RFI (93 g/d) and FI (122 g/d) than the control line with no significant change in ADG and BF, although there was a tendency for the LRFI line to have lower growth. Estimates of response based on direct comparison of lines were Estimates of response based on direct comparison of lines were lower than estimates based on average EBV from analysis of data observed on selection line animals only. This may because RFI was evaluated over a different time period and on gilts versus boars.

Acknowledgements

FIRE feeders were donated by PIC. Funds were from the Center for Integrated Animal Genomics.

Table 1. Estimates of phenotyic standard deviations, heritability and differences between the LRFI and control lines based on estimates of breeding values and direct phenotypic comparison.

Trait	Phenotypic standard deviation	Heritability ± st.error	Line difference (LRFI-control) estimated based on	
			EBV in LRFI line	Phenotypic comparison
RFI (g/d)	130	0.30 ± 0.09	-123	-93***
FI (g/d)	187	0.46 ± 0.10	-153	-123***
ADG (g/d)	79	0.33 ± 0.09	-13	-22^{NS}
BF (mm)	3	0.67 ± 0.11	-0.47	0.063^{NS}

*** Significant at P<.01 ^{NS} Not significant at P<.10